OFF-SITE CONSEQUENCE ANALYSIS FOR:

TOWERJAZZ

SEMICONDUCTOR

FACILITY

prepared for:

CITY OF NEWPORT BEACH

Contact:
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1. Introduction

1.1 PURPOSE

This report presents the results of an off-site consequence analysis that assesses the potential impact of chemical releases from the TowerJazz Semiconductor Facility to residents of Phase 1 of the Uptown Newport project. For this report, off-site is defined as any activity or receptors located beyond the boundaries of the TowerJazz facilty. The TowerJazz Semiconductor Facility would continue operation during construction and occupancy of Phase 1 of the project. During Phase 2 of the project, the TowerJazz facility would be closed and demolished during site clearance activities.

1.2 SITE LOCATION AND PROJECT

The 25.05-acre project site is within the Airport Area of the City of Newport Beach, County of Orange, California. It is on the east side of Jamboree Road, between Birch Street and the intersection of Von Karman Avenue and MacArthur Boulevard. The proposed project would be a multi-family residential community with neighborhood-serving retail uses. The site plan includes up to 1,244 residential units, 11,500 square feet of retail, and 2 acres of planned park area.

There are two existing onsite industrial buildings at 4311 and 4321 Jamboree Road. The TowerJazz Semiconductor Facility, which is located at 4321 Jamboree Road and is within the project site boundaries, would remain in operation during Phase 1 of the project. The other business would be closed and the building would be demolished during Phase 1. The proposed schedule indicates that Phase 1 residences would be available for occupancy in 2018. Although Phase 2 is scheduled to begin in 2021, the TowerJazz facility could extend their manufacturing operations until 2027 if a subsequent lease option is exercised. Therefore, operations at the TowerJazz facility could continue for a period of 3 to 9 years with adjacent residential use.

The location of the residential units for Phase 1 of the Uptown Newport project and the location of the chemical storage areas at the TowerTowerJazz Semiconductor Facility are shown in Figure 1.

1.3 REGULATORY REQUIREMENTS

The Newport Beach Fire Department has adopted an amendment to the California Fire Code (Section 2704.1.1), which states the following:

> *No person shall use or store any amount of extremely hazardous substances (EHS) equal to or greater than the disclosable amounts as listed in Appendix A, Part 355, Title 40 of the Code of Federal Regulations in a residential zone or adjacent to property developed for residential uses.*

There are five extremely hazardous substances that are stored in quantities above the reportable quantities (RQ) listed in Appendix A, as shown in Table 1. The chemicals listed in Table 1 and summarized herein will be analyzed in this report:

- Anhydrous ammonia
- Boron trichloride
- Chlorine
- Hydrofluoric acid (49%)
- Sulfuric acid

1.4 REPORT OBJECTIVES AND METHODOLOGY

The purpose of this off-site consequence analysis report is to meet the following objectives:

- Identify and characterize the quantities and locations of hazardous chemicals stored at the TowerJazz Semiconductor Facility;
- Determine the distance from the chemical storage locations to the nearest residences for Phase 1 of the Uptown Newport project;
- Conduct computer modeling using USEPA's RMP or ALOHA computer program to determine worst-case accident release scenarios and alternative release scenarios and distances to the toxic endpoints;
- Determine potential impacts and safety risks at the nearest residential receptor; and
- As appropriate, identify and develop mitigation measures to reduce risk to an acceptable level.

As per discussions with the City of Newport Beach, the methodology used in this report includes the following:

- Worst-case scenario – analyzed using USEPA's computer model RMP*Comp, nighttime meteorological conditions (Stability Class F and wind speed of 1.5 m/sec), and instantaneous release from the largest container stored on-site. Passive mitigation measures, such as diked areas or releases within buildings, can be considered as per USEPA guidance
- Alternative release scenario – analyzed using RMP*Comp assuming daytime meteorological conditions (Stability Class D and wind speed of 3 m/sec) and ALOHA using nighttime meteorological conditions. Alternative release scenarios consider more realistic release scenarios, such as a break in the piping or tubing of the storage vessel, and active mitigation measures, such as automatic shutoff valves and/or water spray mitigation, can be considered as per USEPA guidance
- The impacts and risks to Phase 1 residential receptors were determined using the toxic endpoints specified in Appendix A to 40 CFR 68.
- Because sulfuric acid in not in the RMP*Comp database of chemicals, the worst-case and alternative case scenarios for this chemical were analyzed, using the ALOHA computer program.

1.5 REFERENCES USED IN ANALYSIS

The following references were used to develop accident scenarios and evaluate risk to occupants of the Phase 1 Uptown Newport project:

- *California Accidental Release Prevention (CalARP) Program, Administering Agency Guidance.* Office of Emergency Services (OES). January 2005.

- *Risk Management Program Guidance for Offsite Consequence Analysis.* US Environmental Protection Agency (USEPA). March 2009. EPA Report No. 550-8-99-009.

- *Supplemental Risk Management Program Guidance for Wastewater Treatment Plants. Appendix F.* USEPA. March 2009.

- *Technical Background Document for Offsite Consequence Analysis for Anhydrous, Aqueous Ammonia, Chlorine, and Sulfur Dioxide.* USEPA. April 1999

- *RMP*Comp.* USEPA computer model, Version 2.01, for performing offsite consequence analysis required under USEPA's Risk Management Program (RMP) rule. 2012. Website: http://www.epa.gov/oem/content/rmp/rmp_comp.htm

- *Areal Location Hazardous Atmospheres (ALOHA) computer model*. 2007.

- *Guidelines for Chemical Process Quantitative Risk Analysis.* American Institute of Chemical Engineers. 2000.

2.1 CHEMICAL USAGE, STORAGE LOCATIONS, AND SAFETY PROVISIONS

A current list of the extremely hazardous chemicals used at the TowerJazz Semiconductor Facility that exceed reportable quantities is provided in Table 1. The chemical storage locations and the maximum container volumes used for this analysis are provided in Table 2. The storage locations of the chemicals are shown on Figure 1.

Anhydrous ammonia is currently stored in a 2,224-gallon pressurized tank located south of the cooling towers. TowerJazz is currently evaluating the relocation of this tank. The storage area, which also includes four wastewater neutralization tanks, is partially enclosed with three walls and a roof. The entire area, which is diked with dimensions of 30 feet by 117 feet by 1.5 feet high, would contain a catastrophic simultaneous release from all four tanks. Other mitigation safeguards include:

- The ammonia storage area is equipped with a water spray mitigation system, which consists of water fog sprays that effectively disperse a vapor cloud and cool the vessel in the case of a fire
- The area is equipped with alarms, pressure relief valves, excess flow valves, and emergency block valves to prevent or limit the severity of a release
- The area is equipped with an ammonia leak detection system with audible and security center alarms. The water spray mitigation system will activate automatically upon receiving a signal from the alarm system
- The ammonia tank volume is limited to 85% of the total capacity to reduce the quantity of ammonia available for release
- The outdoor enclosure is protected by closely spaced traffic posts to prevent delivery trucks from accidentally backing into the tank area
- An emergency shut-off panel is located at the tank and at the northwest corner of the Pacific Building

Boron trichloride is stored in 110-lb cylinders in various locations on the second floor of the main (Atlantic) Building. For purposes of this analysis, it is assumed that at least one cylinder is located in the gas storage room along the south side of the Atlantic Building, which would be the closest location to Phase 1 residences for the proposed project. The gas storage room has two-hour rated fire walls and doors and is equipped to withstand pressures of up to 150 psi. Full sprinkler protection is also provided in the room as well as a toxic gas monitoring system (TGMS) with automatic shutdown. Upon detection of a release by the TGMS, the system is wired to close the automatic control valves and stop the flow of gas. Also, the cylinders are contained in a 2-cylinder gas cabinet with continuous ventilation as per the 2010 California Fire Code. Exhaust from the gas cabinets is vented to a scrubber before discharge to the atmosphere.

Chlorine is currently stored in 110-lb cylinders in the gas room on the second floor of the Bulk Chemical Storage Building, which is located along the northwest side of the Atlantic Building. The Bulk Chemical Storage Building is a two story, 34-foot by 110-foot seismic rated steel frame building with reinforced concrete block walls. The building was base isolated as part of the 2000 earthquake upgrade project. The gas room is also equipped with a TGMS, which upon activation will automatically stop the chemical flow and close the automatic control valves. The chlorine cylinders are also contained within gas cabinets with continuous ventilation, which are vented to a scrubber prior to atmospheric discharge.

The hydrofluoric acid (49% and 5%) is delivered in 55-gallon drums and transferred into day tanks with a maximum capacity of 211 gallons in Bay 1 of the Bulk Chemical Storage Building. The building is divided into six bays with separate areas for acids, base/oxidizers, and solvents. Each area is provided with containment for a spill involving the largest container and is protected by a sprinkler system. High level exhaust is also provided. There is no TGMS or chemical sensors in the area where the acids are stored.

Sulfuric acid (96%) is stored in a 200-gallon tank in Bay 1 of the Bulk Chemical Storage Building. However, there also is a 2,000-gallon tank of 93% sulfuric acid connected to the air scrubbing system that is located in the Central Plant just southwest of the cooling towers. The Central Plant is constructed as a metal deck canopy on a steel frame supported by steel columns. It is open on three sides, with the north side being a free standing concrete block wall. The floor is concrete slab on grade. The Central Plant was subject to seismic retrofit in 2000 during the TowerJazz earthquake upgrade project.

Additional details regarding safety devices, fire systems, chemical handling, and emergency response procedures can be found in the 2012 *Business Emergency Plan* (TowerJazz Semiconductor, 2012). TowerJazz uses a just-in-time (JIT) inventory system which limits the amount of chemicals that are stored on-site.

2.2 LAND USE AND TERRAIN

Currently, there is no residential land use in the area of the TowerJazz Semiconductor Facility. However, the proposed Uptown Newport project would place multi-family residences in close proximity to this facility. Based on the Alta survey and architectural drawings provided by the applicant, the distances from the storage locations to the nearest proposed Phase 1 residence are as follows:

- Anhydrous ammonia – 5 feet
- Boron trichloride – 110 feet
- Chlorine – 190 feet
- Hydrofluoric acid (49%) – 235 feet
- Sulfuric acid (93%) – 100 feet

Topography in the area is relatively flat, with a slight gradient to the west. In the unlikely event of an accidental release of chlorine or hydrofluoric acid from the Bulk Chemical Storage Building, the main (Atlantic) building is between the chemical storage building and the nearest proposed residence and could partially block or buffer vapor releases. There would be minimal blocking or buffering of ammonia vapors if an incident were to occur at the location of the outdoor ammonia storage area; the only intervening structure is the concrete block wall on the backside of the storage area. There also would be minimal structures or buildings to block or buffer gas releases to the nearest residential receptor if an incident were to occur where the boron trichloride cylinders are stored along the southeast wall of the Atlantic Building. However, these cylinders are stored within an enclosed space, which would minimize any gas release to the outdoors. There are no intervening structures between the Central Plant and the proposed residences in Phase 1; however, a sulfuric acid spill in this area would result in a pool with a slow rate of evaporation and minimal vapor dispersion.

2.3 OFFSITE CONSEQUENCE ANALYSIS METHODOLOGY

The US Environmental Protection Agency's Risk Management Program (RMP) and the California Accidental Release Prevention (CalARP) Program require off-site consequence analyses (OCAs) to have two elements: 1) a worst-case release scenario, and 2) an alternative release scenario. The worst-case scenario is defined as a release from the largest quantity of a regulated substance from a single vessel or process unit that results in the greatest distance to a toxic or flammable endpoint. Alternative release

scenarios are scenarios that are more likely to occur than the worst-case scenario. Modeling assumptions and meteorological conditions that must be used in conducting the OCA are specified in the California Code of Regulations (CCR), Title 19, Chapter 4.5, Article 2735.1 et seq.

As per the CalARP program and USEPA RMP guidance, worst-case scenario assumptions that were used in these analyses are as follows:

- Release of the largest quantity of a regulated substance from the largest vessel or container within a process
- Nighttime conditions - wind speed of 1.5 meters per second (m/sec) and worst-case atmospheric stability class F
- Default release temperature of 77°F for toxic gas releases and release temperature of 87°F as the highest daily maximum within the last 3 years for Newport Beach for toxic liquids
- Humidity of 50%
- Height of release – ground level
- Surface roughness – urban
- Passive mitigation, such as dikes or releases inside of buildings, can be considered as part of the worst-case scenario, as per USEPA and CalARP guidance.

Alternative release scenarios are based on more likely accident occurrences, such as a release from a hole in a vessel or piping. Also, active mitigation measures, such as automatic shutoff valves or water spray mitigation, can be considered in developing the alternative scenario.

Water solutions containing regulated substances, such as hydrofluoric acid, are analyzed differently from pure toxic liquids. The evaporation rate varies with the concentration of the solution. If a concentrated water solution is spilled, the toxic substance will evaporate more quickly than the water from the spilled solution, and the vapor pressure and evaporation rate will decrease as the concentration of the toxic substance in solution decreases.

For estimating release rates from the chemical solutions that are stored at the TowerJazz facility, the procedures described in the USEPA's *Risk Management Program Guidance for Offsite Consequence Analysis (*Exhibit B-3*)* were used. Only the first 10 minutes of the release were considered in the analysis, as per the USEPA guidance. The toxic component in the solution evaporates fastest during the first few minutes of a spill when its concentration is highest. Although the toxic substance will continue to evaporate from the pool after 10 minutes, the rate of evaporation is so much lower than it can be safely ignored in estimating the consequence distance.

For worst-case scenarios, the USEPA computer model RMP*Comp was used, except for the evaluation of sulfuric acid. The RMP*Comp program does not contain sulfuric acid in its database; therefore, the USEPA ALOHA was used for this chemical. For alternative release scenarios, both the computer programs RMP*Comp and ALOHA were used.

RMP*Comp is a screening tool that does not have the flexibility that ALOHA has for modeling mitigation measures and meteorological conditions. The RMP*Comp alternative analysis scenario does not have the option to consider nighttime conditions for the alternative model runs. Also, toxic endpoint distances

less than 0.1 mile are not reported. Therefore, the ALOHA model was also run for the alternative scenarios, using the same input parameters as RMP*Comp, but assuming nighttime meteorological conditions (Stability Class F and wind speed of 1.5 m/sec). The ALOHA model can calculate toxic endpoint distances in the near field so that more accurate safe separation distances can be calculated. Because the TowerJazz facility operates 24 hours per day, the ALOHA runs using low wind speeds and more stable conditions representative of nighttime conditions are considered to be a "worst-case" alternative release scenario. The assumptions used for the alternative release scenarios were as follows:

- Process piping release assuming a complete break in the supply line; piping diameters provided by TowerJazz:
  - Ammonia tank – 1-inch black iron pipe
  - Boron trichloride – ¼-inch line
  - Chlorine – Restrictive Flow Orifice (RFO) on cylinder to limit release – 0.03-inch
  - Hydrofluoric acid and sulfuric acid – assumed spillage of all or 10% of tank contents
- RMP*Comp - daytime conditions - wind speed of 3.0 m/sec and daytime atmospheric Stability Class D
- ALOHA – nighttime conditions – wind speed of 1.5 m/sec and Stability Class F
- Default release temperature of 77°F for toxic gas releases and release temperature of 87°F as the highest daily maximum within the last 3 years for Newport Beach for toxic liquids
- ALOHA – nighttime relative humidity of 80% (based on climate data for Newport Beach)
- ALOHA – nighttime temperature of 56°F (based on average nighttime temperature from climate data for Newport Beach)
- Height of release – ground level (although the boron trichloride and chorine gas cabinets are vented to stacks on the top of the building, it was conservatively assumed that receptors in multi-story units would be at the same height as the release)
- Surface roughness – urban
- Active mitigation measures, such as automatic shutoff valves or water spray mitigation systems, were considered as appropriate.

The toxic endpoints listed in Appendix A of 40 CFR 68 were used to determine safe distances for this analysis. The toxic endpoints are either 1) the Emergency Response Planning Guideline 2 (ERPG-2), which is defined as the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair an individual's ability to take protective action, or 2) Level of Concern (LOC) derived for extremely hazardous substances. The toxic endpoints established by CalARP and USEPA that were used in the analysis are as follows:

- Anhydrous ammonia – 200 ppm (ERPG-2)
- Boron trichloride – 2 ppm (LOC)
- Chlorine – 3 ppm (ERPG-2).
- Hydrofluoric acid (49%) – 20 ppm (ERPG-2)
- Sulfuric acid – 10 mg/m^3 (ERPG-2)

The calculations and RMP*Comp and ALOHA computer output are provided in Appendix A. A summary of the results for each evaluated chemical is provided in the following sections.

2.4 ANHYDROUS AMMONIA ANALYSIS

The 2,224-gallon anhydrous ammonia storage tank is located in an outside enclosure just south of the cooling towers. Although TowerJazz is in the process of evaluating potential locations for relocation of this tank, it currently is approximately 5 feet from the nearest proposed Phase 1 residence.

Ammonia is a colorless gas with a characteristic pungent odor; its chemical formula is NH_3. Ammonia is easily liquefied by applying low pressure to the confined gas; this form is called anhydrous ammonia. The vapor density of ammonia is 0.59; therefore, ammonia typically is lighter than air and quickly disperses into the atmosphere when released. However, when large amounts of liquid ammonia are released to the atmosphere at once, the ammonia is initially cold and heavier than air. When first released from its liquid storage tank, ammonia is generally visible as a white fog caused by condensed atmospheric moisture.

Ammonia acts as an alkali on human skin. Its effect can range from mild irritation to tissue destruction, depending on the length of exposure. The eyes and lungs are particularly susceptible to the caustic action of ammonia. Symptoms can include burning of the eyes, nose, and throat after breathing even small amounts. With higher doses, coughing or choking may occur. Exposure to high levels of anhydrous ammonia can cause swelling of the throat and/or chemical burns to the lungs. Most people recover from a single low exposure to anhydrous ammonia without any delayed or long-term effects. Anhydrous ammonia is not known to cause cancer.

For the worst-case scenario, the procedures described in the USEPA OCA guidance document (1999) were used. It was assumed that all of the anhydrous ammonia in the tank was released over a period of 10 minutes and the release took place during worst-case meteorological conditions (Stability Class F and wind speed of 1.5 m/sec). No credit was taken for passive mitigation measures. The release was modeled using the computer program RMP*Comp.

The results, which are provided in Appendix A, indicate that the ammonia toxic endpoint of 200 ppm would extend approximately 1.2 miles. The nearest residential receptor in Phase 1 of the proposed development would be approximately 5 feet from the ammonia storage location and therefore has the potential to be adversely impacted. Worst-case scenarios do not take into account the probability of a catastrophic release occurring. Industry data indicate that the probability of a catastrophic ammonia vessel failure is 3.0×10^{-8}/year, or once every 33 million years (Marine Research Scientists, 2007).

The USEPA RMP and CalARP protocols also require identification of an alternative release scenario that is more realistic or more likely to occur. For this alternative release scenario, a break in the vapor feed line from the anhydrous ammonia storage tank was assumed. This is a conservative assumption because the 1-inch line is enclosed by secondary containment piping. In the event of a feed line break, the exterior pipe should contain any release. If the internal and external piping both break, there are isolation valves and excess flow valves that would limit the amount of ammonia released.

Airgas Specialty Products provided specifications for the excess flow valves that are installed at the ammonia storage tank. The information provided indicates that the valves will close when the flow in the 1-inch line exceeds 9.38 lb/min. This was therefore assumed to be the maximum possible flow rate in the line for the alternative scenario analysis; actual operating flow rates will be lower than this amount. Based on the presence of automated alarms, toxic gas detection system, ammonia diffusion system, and

automatic shutoff valves, it is anticipated that the duration of any release of ammonia would be much less than one minute. However, a one-minute release duration was assumed for the hazard assessment.

In addition, there is a high volume water spray system surrounding the ammonia tank, which is designed to activate upon detection of ammonia in the atmosphere. The water spray is intended to intercept the released ammonia vapor and effectively knock the plume down aerodynamically and convert a large fraction of the ammonia into aqueous form for subsequent cleanup. The ammonia storage area is diked and has enough capacity to contain any water released from the water spray system. The control efficiency of the water spray system is estimated to be 90% or greater at releases less than 660 lb/min (AIChE, 1997). Credit can be taken for active mitigation systems, such as water spray systems, and automatic shutoff valves, when evaluating alternative release scenarios.

The RMP*Comp results for the alternative release scenario indicate a toxic endpoint distance of <0.1 mile, or approximately 528 feet. However, the model does not calculate distances of less than 0.1 mile. Therefore, the ALOHA model was run, using nighttime meteorological conditions, to get a more exact endpoint distance. The results indicate that the toxic endpoint of 200 ppm would extend to a distance of 192 feet. Since the ammonia tank currently is located at a distance of 5 feet from what would be the nearest Phase 1 residence, it is recommended that the ammonia tank be relocated to a distance of at least 200 feet from the nearest proposed residence, which would be a safe separation distance.

2.5 BORON TRICHLORIDE ANALYSIS

Boron trichloride is a colorless gas with a pungent, irritating odor; its chemical formula is BCl_3. Exposure to vapor concentrations above 5 ppm irritates the upper respiratory tract. High concentrations (greater than 50 ppm) cause the throat to burn and producing choking and coughing. Pulmonary edema, general lung injury, and ulceration to the nose, throat, and larynx can also occur. Boron trichloride also causes severe skin irritation, chemical burns with ulceration, and potential scarring. Eye contact causes immediate pain and irritation with excess tearing and blinking. The gas reacts with moisture in the air to form hydrochloric acid.

Boron trichloride is stored in several locations on the second floor of the Atlantic Building. The gas is stored in 110 lb. cylinders, so the largest release amount for the worst-case scenario was considered to be 110 lb. The gas is liquefied under low pressure (4.4 psig). For this analysis, the boron trichloride was assumed to be located in the process gas storage area, which would be the nearest location to a residential receptor during Phase 1 of the proposed project (110 feet). Because the release would occur inside a building, credit was taken for this passive mitigation measure for the worst case scenario.

For the worst-case scenario, the computer model RMP*Comp was run, using the methodology and assumptions described in Section 2.3 and assuming a release inside the building (passive mitigation). The output indicates that the distance to the toxic endpoint of 2 ppm would extend out to 0.7 mile. Because the nearest potential receptor is located approximately 110 feet from the process gas storage area, this receptor could be exposed to adverse health impacts. Therefore, an alternative more realistic release scenario was prepared for this chemical.

A rupture of the process piping connected to the cylinder was assumed for the alternative release scenario. The process line is constructed of ¼-inch poly tubing with clear PVC secondary containment piping; it was assumed that both the inner and outer piping ruptured. A release duration of 1 minute was assumed, because the storage area is equipped with a toxic gas monitoring system that automatically activates shutoff valves upon the detection of gas. In addition, credit was taken for the dilution ventilation in the gas cabinet, which is required by the California Fire Code. The released gas would be diluted with ambient air before being released through a stack at the top of the building. Also, the exhaust from the

gas cabinets are vented to a scrubber prior to discharge to the atmosphere, this additional mitigation measure was not included in the analysis. Credit also was not taken for an elevated release, because receptors at the multi-story Phase I development may be located at a similar height as the top of the building.

Results from RMP*Comp estimate a distance to the toxic endpoint of 0.1 mile, or approximately 528 feet. However, the USEPA RMP*Comp is a screening model and does not calculate near-field distances (i.e., less than 0.1 mile). Therefore, the computer model ALOHA was also run, using the same input parameters but assuming nighttime conditions. The ALOHA results indicate a distance to the toxic endpoint of 84 feet. Since the nearest proposed receptor is located at a distance of 110 feet, no adverse impacts are expected.

2.6 CHLORINE ANALYSIS

Chlorine is a non-flammable, greenish-yellow gas with a pungent odor. The gas is denser than air and will stay close to the ground when released into the atmosphere. It is corrosive because it forms hydrochloric acid when combined with water and is a powerful oxidant. Chlorine is highly irritating to the skin, eyes, and mucous membranes. It acts as a choking agent on the lungs, causing breathing difficulties and potential lung damage. It creates a burning sensation, cough, headache, labored breathing, nausea, and a sore throat. It can be very painful, causing skin burns, eye pain, blurred vision, and severe deep burns with close contact.

At the TowerJazz facility, chlorine is stored in 110 lb. cylinders in the gas room of the Bulk Chemical Storage Building. The nearest receptor for the proposed Phase 1 project would be located at a distance of approximately 190 feet. The release from one cylinder containing 110 lb. is considered for the worst-case analysis. Credit was also taken for passive mitigation measures, because the release would occur inside a building.

The computer model RMP*Comp was run to determine the toxic endpoint distance for the worst-case release scenario. The worst-case release rate was calculated to be 6.05 lb/min and the distance to the toxic endpoint of 3 ppm was estimated to be 0.2 mile, or 1,056 feet. Because the nearest receptor at 190 feet could be subject to adverse health impacts under the worst case scenario, an alternative release scenario was evaluated for this chemical.

As was the case for boron trichloride, a break in the process piping from the cylinder was assumed for the alternative scenario, resulting in a continuous release. Credit was taken for restrictive flow orifices (RFOs), which limit the release rate of chlorine if a rupture of the line were to occur. The RFOs on the chlorine cylinders have a diameter of 0.03 inch. A release duration of 1 minute was assumed, based on the detection of gas from the toxic gas monitoring system and automatic activation of the shutoff valves; dilution ventilation from the gas cabinet was also considered in the analysis. However, credit for the exhaust gases passing through a scrubber was not considered, so the analytical results are conservative.

Results from RMP*Comp estimate a distance to the toxic endpoint of <0.1 mile, or less than 528 feet. Because RMP*Comp does not calculate distances of less than 0.1 mile, the computer ALOHA was also run.

Results from the ALOHA run assuming nighttime conditions indicate that the distance to the toxic endpoint would be less than 33 feet. All process gases are configured with double containment process piping, gas detection systems, automatic shutoff valves triggered by excess flow or gas detection, restricted flow orifices (RFOs) on the cylinders, automated purge panels, and are located in ventilated

gas cabinets. All of these safety features will minimize the potential for a gas release to the atmosphere. The distance to the nearest receptor for the Phase 1 development is 190 feet. Therefore, no adverse health impacts are expected to occur with the more realistic, alternative release scenario.

2.7 HYDROFLUORIC ACID ANALYSIS

Hydrofluoric acid is a clear, colorless liquid, miscible with water, with an acrid, irritating odor. It is an extremely corrosive liquid and vapor that can cause severe injury via skin and eye contact, inhalation, or ingestion. Dilute solutions deeply penetrate before dissociating, thus causing delayed injury and symptoms. Skin contact results in painful deep-seated burns that are slow to heal. Burns from dilute (<50%) HF solutions do not usually become apparent until several hours after exposure. Hydrofluoric acid and HF vapor can cause severe burns to the eyes, which may lead to permanent damage. At 10 to 15 ppm, HF vapor is irritating to the eyes, skin, and respiratory tract. Exposure to higher concentrations can result in serious damage to the lungs. Hydrofluoric acid has not been reported to be a human carcinogen.

Hydrofluoric acid at concentrations of 49% and 5% are used at the TowerJazz facility. The chemicals are delivered in 55-gallon drums and stored in 211-gallon day tanks in Bay #1 of Bulk Chemical Storage Building. The analysis was conducted for 49% hydrofluoric acid as a worst-case scenario; 5% hydrofluoric acid would have lower release rates and shorter distances to the toxic endpoints.

For the worst-case scenario, the entire contents of the 211-gallon 49% hydrofluoric acid tank (2,026 lb) were assumed to spill onto the floor of the storage bay (Bay #1) in the Bulk Chemical Storage Building. Passive mitigation measures (i.e., a release inside the building) were assumed for the RMP*Comp computer run. The results for the worst-case scenario indicate that the distance to the toxic endpoint would extend 1.2 miles. Since the nearest proposed residential receptor is at a distance of 235 feet, potentially adverse impacts could occur under the worst-case scenario. Therefore, a more realistic alternative release scenario was also conducted.

For the alternative release scenario, it also was conservatively assumed that the entire contents of the HF acid tank spilled onto the floor. Additional passive mitigation measures (release within the building) were assumed. The USEPA OCA Guidance indicates that if a liquid is released inside a building, its release rate to outside air will be mitigated in two ways (USEPA, 2009). First, the evaporation rate of the liquid will be much lower inside the building, due to minimal wind speed, which affects the evaporation rate. The second mitigating factor is that the building provides resistance to the discharge of contaminated air to the outdoors. Only the first 10 minutes of evaporation are considered for solutions at ambient temperature, because the evaporation rate decreases rapidly as the substance evaporates and the concentration of the solution decreases.

For the hydrofluoric acid alternative release scenario, a wind speed of 0.1 m/sec inside the building was assumed, as per the OCA guidance (USEPA, 2009, p. D-5), resulting in a wind factor of 0.166. Also, USEPA considers a building to have an overall mitigation factor of 10% (0.10). These two factors were used to calculate a release rate of 0.02 lb/min for the alternative release scenario.

The RMP*Comp results for the alternative release scenario indicate a toxic endpoint distance of 0.1 mile, or 528 feet. Because the RMP*Comp program does not provide endpoint distances of less than 0.1 mile, the ALOHA computer program was also run.

The results from the ALOHA computer program, using nighttime meteorological conditions, indicate that the hydrofluoric acid toxic endpoint of 20 ppm would extend approximately 81 feet from Bay #1. The

nearest residential receptor in Phase 1 of the proposed development would be approximately 235 feet away and therefore would not be adversely impacted.

2.8 SULFURIC ACID ANALYSIS

Sulfuric acid is a colorless, oily liquid with a density about twice that of water. Its chemical formula is H_2SO_4. It is a highly corrosive acid that can cause burns to the skin and respiratory symptoms, such as upper respiratory irritation, lung irritation, wheezing, shortness of breath, and a burning sensation with acute exposure. However, sulfuric acid has a very low vapor pressure (< 1.0 mm Hg) and therefore, vapors generated from the evaporation of spilled liquid are minimal and impacts are not likely to extend off-site. Concentrated sulfuric acid should not be confused with oleum, or fuming sulfuric acid, which is formed when an excess of sulfur trioxide is dissolved in concentrated sulfuric acid. Its chemical formula is $H_2S_2O_7$.

Sulfuric acid is listed as an extremely hazardous substance (EHS) in Appendix A, Part 355 of Title 40 CFR at a reportable quantity of 1,000 lb. It is not included in the CalARP list of State regulated substances unless it meets the definition of oleum. Sulfuric acid also is not included as a chemical in the USEPA RMP guidance document nor is it included in the 40 CFR 68 Appendix A for toxic endpoints. It also is not included in the RMP*Comp and ALOHA computer databases. Oleum (also known as fuming sulfuric acid) is listed in the USEPA guidance document and in the ALOHA database. For this worst-case analysis, it was conservatively assumed that the sulfuric acid stored in the Bulk Chemical Storage Building contains 4% sulfur trioxide (oleum). However, the actual amount of oleum in 96% sulfuric acid is negligible. Nevertheless, to be conservative, a 4% oleum concentration was used as input into the ALOHA model to simulate a release of sulfuric acid. Because sulfuric acid is not included in the RMP*Comp database, both the worst-case and alternative release scenarios were modeled using ALOHA.

Sulfuric acid is stored in two locations at the TowerJazz facility. A 200-gallon tank of 96% sulfuric acid is stored in Bay 1 of the Bulk Chemical Storage Building and is used for chip wafer fabrication. There also is a 2,000-gallon tank of 93% sulfuric acid located in the central plant building just southwest of the cooling towers, which is used for the air scrubbers. Because the 93% sulfuric acid tank has a larger capacity and is located closer to the proposed residences for Phase 1, this was evaluated for the worst-case scenario. This tank is located approximately 100 feet from the nearest proposed residence.

The worst-case analysis assumed that the largest container of sulfuric acid stored on-site (2,000 gallon tank) was released within the area of the Central Plant. The tank has secondary containment but is not located within a diked area and the central plant is open to the atmosphere (walled on three sides with a roof). Therefore, the worst-case scenario was assumed to take place outdoors with no passive mitigation measures. The ALOHA model calculates an evaporation rate based on the amount of liquid spilled and the formation of a pool that is 1 centimeter deep. However, it should be noted that this release scenario is based on 4% oleum, which evaporates at a much higher rate than 93% sulfuric acid, and therefore, these results are conservative. The results from the ALOHA model for the worst-case scenario indicate that the distance to the toxic endpoint would be 252 feet. Since the nearest receptor would be 100 feet from the central plant, there is the potential for adverse impacts, and an alternative release scenario was postulated.

For the alternative release scenario, it was assumed that there was a release of 10% of the contents of the 2,000-gallon, either due to a hole in the tank or a break in the piping. The ALOHA model predicted a distance to the toxic endpoint of 57 feet, which is much less than the distance to the nearest receptor (100 feet). Therefore, no adverse impacts are expected from this release scenario.

2.9 SUMMARY AND RECOMMENDATIONS

The results of the offsite consequence analyses are summarized in the following table:

Chemical	Anhydrous Ammonia	Boron Trichloride	Chlorine	Hydrofluoric Acid	Sulfuric Acid
Distance to Nearest Residential Receptor (ft)	5	110	190	235	100
RMP*Comp Worst-case Analysis – Distance to Toxic Endpoint (ft)	6,336	3,696	1,056	6,336	252*
Toxic Endpoint Exceeded at Residential Receptor?	Yes	Yes	Yes	Yes	Yes
RMP*Comp Alternative Release Analysis – Distance to Toxic Endpoint (ft)	<528	528	<528	528	--
Toxic Endpoint Exceeded at Residential Receptor?	Yes	Yes	Yes	Yes	--
ALOHA Alternative Release Analysis – Distance to Toxic Endpoint (ft)	192	84	<33	81	57
Toxic Endpoint Exceeded at Residential Receptor?	Yes	No	No	No	No

*Worst case analysis run with ALOHA model; sulfuric acid not in RMP*Comp database

The worst-case scenario results are conservative for the following reasons:

- No credit was taken in the analyses for active mitigation measures or safety features such as automatic sprinkler system, toxic gas monitoring system (TGMS,) and automatic control valves
- The analyses do not consider the probability of the release occurring
- It is assumed that the wind would be blowing directly toward the receptor; wind rose data for the nearest meteorological station (Costa Mesa) indicate that the prevailing wind is from the southwest
- Residents typically would be indoors during nighttime hours (Stability Class F conditions)

The alternative release scenarios indicate that the toxic endpoints would not extend to the residential receptors, with the exception of anhydrous ammonia. TowerJazz plant personnel are currently in the process of evaluating relocation of the 2,224-gallon storage tank. It is recommended that the tank be located at least 200 feet from the nearest residence, which would be a safe separation distance.

Although the TowerJazz facility will only be in operation for an additional 3 to 9 years until construction begins on Phase 2, because of the close proximity of residential receptors to the facility, the following actions are recommended:

- The anhydrous ammonia tank should be relocated to a distance of 200 feet from the nearest residential receptor
- Disclosure should be made to potential occupants of the residential community that hazardous chemicals are used and stored at the adjacent facility
- The property manager or authorized representative of the Uptown Newport residential community should be added to the emergency notification list of the TowerJazz Facility's Business Emergency Plan
- The property manager or authorized representative of the residential community should be knowledgeable in emergency response and evacuation procedures and coordinate with the TowerJazz Facility to initiate proper actions in the event of an accident at the plant (shelter in place and/or evacuation routes).

3. References

1. American Institute of Chemical Engineers (AIChE), 2000. *Guidelines for Chemical Process Quantitative Risk Analysis, Second Edition.* New York, New York. 750 pp.
2. AIChE, 1997. *Guidelines for Post-Release Mitigation Technology in the Chemical Process Industry.* New York: American Institute of Chemical Engineers Center for Chemical Process Safety (CCPS). Prepared by Arthur D. Little, Inc.
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4. Marine Research Scientists, 2007. *Anhydrous Ammonia Consequence Modeling Analysis: Evaluation of an Accidental Anhydrous Ammonia Release from the Chevron Richmond Refinery and Consequences in the Point Molate Area.* Dated January 2007.
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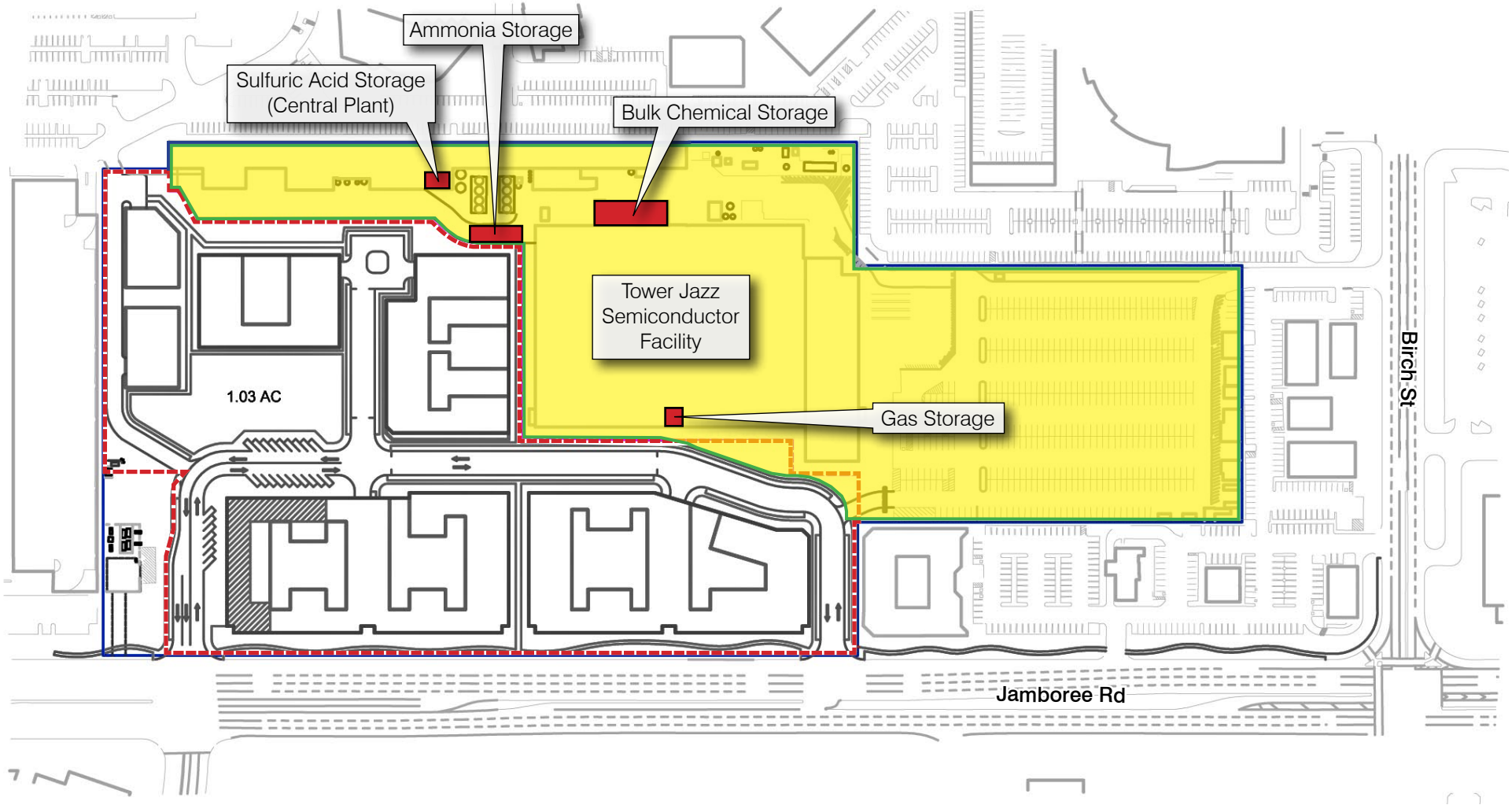
6. United States Environmental Protection Agency (USEPA), 2009. *Risk Management Program Guidance for Offsite Consequence Analysis.* EPA Report No. 550-8-99-009. March 2009.
7. USEPA, 2009. *Supplemental Risk Management Program Guidance for Wastewater Treatment Plants. Appendix F.* March 2009.
8. USEPA, 1999. *Technical Background Document for Offsite Consequence Analysis for Anhydrous, Aqueous Ammonia, Chlorine, and Sulfur Dioxide.* April 1999.

Figures

Phase 1 Site Layout and Chemical Storage Locations



Source: Shopoff Management Inc. 2011

Tables

TABLE 1
CHEMICAL USAGE AT THE TOWERJAZZ SEMICONDUCTOR FACILITY

Chemical Name	Storage Quantity (lbs)	Appendix A Reportable Quantity (lb)	Exceeds Newport Beach Municipal Code 2704-1-1
Anhydrous ammonia	9,713	100	Yes
Boron trichloride	1,540	500	Yes
Chlorine	990	10	Yes
Hydroflouric acid (49%)	3,588	100	Yes
Sulfuric acid	20,000	1,000	Yes

TABLE 2
CHEMICAL LOCATIONS AND MAXIMUM CONTAINER AMOUNTS

Chemical Name	Maximum Container Quantity (gallons)	Density (lb/gal)	Maximum Container Quantity (lbs)	Storage Location	Distance to Nearest Proposed Residence (ft)
Anhydrous ammonia	1,890	5.15	9,734	Outside enclosure south of cooling towers	5
Boron trichloride	--	--	110	Several locations on 2nd floor of fabrication building	110
Chlorine	--	--	110	Bulk chemical storage building - 2nd floor - gas room	190
Hydrofluoric acid 49%	211	9.6	2,026	Bulk chemical storage building - Bay 1	235
Sulfuric acid (93%)	2,000	15.3	30,600	Central plant	100

Appendix A. Calculations/Computer Runs

Anhydrous Ammonia

OFF-SITE CONSEQUENCE ANALYSIS CALCULATIONS

Anhydrous Ammonia - Worst Case Scenario

Storage capacity of tank	2,224	gallons	
Maximum fill volume	85	%	
Maximum volume stored onsite	1,890	gallons	
Density of anhydrous ammonia @ 60F	5.15	lb/gal	
Pounds of ammonia stored onsite	9,736	lb	

No passive mitigation considered for worst-case scenario

Duration of release	10	min	per OCA guidance
Release rate	973.6	lb/min	
Wind Speed	1.5	m/sec	
Stability Class	F		
Temperature	77	F	
Toxic endpoint	200	ppm	
RMP*Comp - distance to	1.2	miles	
toxic endpoint of 200 ppm	6,336	feet	
Distance to nearest residential receptor	5	ft	
Potential impacts to nearest receptor	Yes		

RMP*Comp: Results of Consequence Analysis

Scenario Summary
Aug 13, 2012

Chemical:	Ammonia (anhydrous)
CAS number:	7664-41-7
Threat type:	Toxic Gas
Scenario type:	Worst-case
Physical state:	Liquefied under pressure
Quantity released:	9736 pounds
Release duration:	10 min
Release rate:	974 pounds per minute
Mitigation measures:	NONE
Surrounding terrain type:	Urban surroundings (many obstacles in the immediate area)
Toxic endpoint:	0.14 mg/L; basis: ERPG-2

Estimated distance to toxic endpoint: 1.2 miles (1.9 kilometers)

----------ASSUMPTIONS ABOUT THIS SCENARIO----------

Wind speed:	1.5 meters/second (3.4 miles/hour)
Stability class:	F
Air temperature:	77 F

OFF-SITE CONSEQUENCE ANALYSIS CALCULATIONS

Anhydrous Ammonia - Alternative Release Scenario

Scenario assumes discharge from rupture of 1-inch gas line
Flow restricted by excess flow valve

Specifications on excess control valve from vendor - Airgas Specialty Products
Valve ID - A8013D and A8013DA

Vapor flow rate at 90 psig that triggers closure	12,510	ft^3/hr
	208.5	ft^3/min
Density of anhydrous ammonia vapor	0.045	lb/ft^3
Maximum flow rate with break in 1-inch gas line	9.38	lb/min

Active mitigation considered for alternative release scenario

QR_M = (1-FR) x QR
FR = Fractional reduction resulting from mitigation

Control efficiency of water deluge system	90	%	AIChE, 1997
QR_M = mitigated release rate (lb/min)	0.94	lb/min	
Duration of release	1.00	min	time to activate automatic shutoff valves and water deluge system

Wind Speed	1.5	m/sec
Average nighttime temperature - Newport Beach	56	F
Relative Humidity (nighttime conditions)	80	%
Urban or Rural	Urban	
Ht of release - conservatively assume same height as Phase I receptor in multi-story building	Ground level	

RMP*Comp - distance to toxic endpoint of 200 ppm	<0.1	miles
	<528	feet
ALOHA results - Distance to toxic endpoint of 200 ppm	192	ft
Distance to nearest residential receptor	5	ft
Potential impact to nearest receptor	Yes	

RMP*Comp: Results of Consequence Analysis

Scenario Summary
Aug 30, 2012

Chemical:	Ammonia (anhydrous)
CAS number:	7664-41-7
Threat type:	Toxic Gas
Scenario type:	Alternative
Physical state:	Liquefied under pressure
Release duration:	1 minutes
Release rate:	0.94 pounds per min
Mitigation measures:	NONE
Surrounding terrain type:	Urban surroundings (many obstacles in the immediate area)
Toxic endpoint:	0.14 mg/L; basis: ERPG-2

Estimated distance to toxic endpoint: <0.1 miles (<0.16 kilometers); report as 0.1 mile

----------ASSUMPTIONS ABOUT THIS SCENARIO----------

Wind speed:	3 meters/second (6.7 miles/hour)
Stability class:	D
Air temperature:	77 F

Anhydrous Ammonia - Alternative Scenario
Stability Class F and Wind Speed 1.5 m/sec

Text Summary

ALOHA® 5.4.3

```
SITE DATA:
  Location: NEWPORT BEACH, CALIFORNIA
  Building Air Exchanges Per Hour: 0.29 (unsheltered double storied)
  Time: August 30, 2012  1539 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: AMMONIA                  Molecular Weight: 17.03 g/mol
  AEGL-1 (60 min): 30 ppm   AEGL-2 (60 min): 160 ppm   AEGL-3 (60 min): 1100 ppm
  IDLH: 300 ppm      LEL: 150000 ppm      UEL: 280000 ppm
  Ambient Boiling Point: -28.2° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 1.5 meters/second from N at 3 meters
  Ground Roughness: urban or forest       Cloud Cover: 5 tenths
  Air Temperature: 56° F
  Stability Class: F (user override)
  No Inversion Height                     Relative Humidity: 80%

SOURCE STRENGTH:
  Direct Source: 0.94 pounds/min          Source Height: 0
  Release Duration: 1 minute
  Release Rate: 0.0157 pounds/sec
  Total Amount Released: 0.94 pounds
  Note: This chemical may flash boil and/or result in two phase flow.
     Use both dispersion modules to investigate its potential behavior.

THREAT ZONE:
  Model Run: Gaussian
  Red    : 64 yards --- (200 ppm)
```

Boron Trichloride

OFF-SITE CONSEQUENCE ANALYSIS CALCULATIONS

Boron Trichloride - Worst Case Scenario

Maximum quantity - one cylinder	110	lb
Quantity released	110	lb
Release duration	10	min
Release rate	11	lb/min
Inside building mitigation factor	0.55	
Q (release rate to outdoors)	6.05	lb/min
Wind Speed	1.5	m/sec
Stability Class	F	
Temperature	77	F
Toxic endpoint	2	ppm
RMP*Comp results to	0.7	mi
toxic endpoint of 2 ppm	3,696	ft
Distance to nearest residential receptor	110	ft
Potential impact to nearest receptor	Yes	

RMP*Comp: Results of Consequence Analysis

Scenario Summary
Aug 14, 2012

Chemical:	Boron trichloride
CAS number:	10294-34-5
Threat type:	Toxic Gas
Scenario type:	Worst-case
Physical state:	Liquefied under pressure
Quantity released:	110 pounds
Release duration:	10 min
Release rate:	6.05 pounds per minute
Mitigation measures:	Release in enclosed space, in direct contact with outside air
Surrounding terrain type:	Urban surroundings (many obstacles in the immediate area)
Toxic endpoint:	0.01 mg/L; basis: EHS-LOC; LOC is based on IDLH-equivalent level estimated from toxicity data.

Estimated distance to toxic endpoint: 0.7 miles (1.1 kilometers)

----------ASSUMPTIONS ABOUT THIS SCENARIO----------

Wind speed:	1.5 meters/second (3.4 miles/hour)
Stability class:	F
Air temperature:	77 F

OFF-SITE CONSEQUENCE ANALYSIS CALCULATIONS

Boron Trichloride - Alternative Scenario

Scenario assumes discharge from rupture of process gas line (1/4-inch)

Heat capacity ratio of gas (γ):	1.147				
Hole size based on process piping diameter	6.35	mm	0.25	inch	
Tank pressure (P_1):	131662	Pa	4.4	psig	1.32 bar abs
Ambient pressure(P_2):	101325	Pa			1.01 bar abs
Temperature:	294	K	21 C - tank temperature - specs		
Gas molecular weight:	67.806				

Excess Head Loss Factors:

Entrance:	0.5
Exit:	1
Others:	0
TOTAL:	1.5

Calculated Results:

Hole area:	3.16692E-05	m**2	
Upstream gas density:	3.66	kg/m**3	
Pressure ratio	0.575		
P_{choked}	0.759		

Since P_2 is greater than P_{choked}, flow through hole is subsonic

Equation for discharge under non-choked conditions:

$m = C_d \times A_h \times \sqrt{2 \times P_1 \times \rho \times (\gamma/\gamma-1)[(P_2/P_1)^{2/\gamma} - (P_2/P_1)^{\gamma+1/\gamma}]}$

C_d = discharge coefficient	0.8	USEPA OCA guidance	
A_h = hole area	3.17E-05	m**2	
ρ = gas density	3.66	kg/m**3	
γ/γ-1	7.803		
2/γ	1.744		
(γ+1)/γ	1.872		
m = discharge rate (kg/sec)	0.010	kg/sec	
QR = release rate	1.329	lb/min	
Release duration	1.00	min	active mitigation - activation of automatic shutoff valves

Boron trichloride cylinders are stored in 2-cylinder gas cabinets
Gas cabinets require exhaust ventilation as per 2010 CA Fire Code (Section 3704.1.2)
Requires 200 linear feet/min of air at face of gas cabinet

Vendor minimum ventilation flow rate	250	cfm

Dilution factor with exhaust air
FR = 1 - exp(-WT/V)

W = air flow rate	250	cfm
T = time (minutes)	1	min
V = volume of gas cabinet (25" x 23" x 87")	28.95	ft3
FR	0.9998	
Assume 99% reduction to be conservative	0.9900	
Release rate with mitigation = (1-FR) x QR	0.0133	lb/min

Wind Speed	1.5	m/sec
Average nighttime temperature - Newport Beach	56	F
Relative Humidity (nighttime conditions)	80	%
Urban or Rural	Urban	
Ht of release - conservatively assume same height as Phase I receptor in multi-story building	Ground level	
Toxic endpoint	2	ppm
RMP*Comp - distance to	0.1	miles
toxic endpoint of 2 ppm	528	feet
ALOHA distance to toxic endpoint of 2 ppm	84	ft
Distance to nearest residential receptor	110	ft
Potential impact to nearest receptor	No	

RMP*Comp: Results of Consequence Analysis

Scenario Summary
Aug 30, 2012

Chemical:	Boron trichloride
CAS number:	10294-34-5
Threat type:	Toxic Gas
Scenario type:	Alternative
Physical state:	Liquefied under pressure
Release duration:	1 minutes
Release rate:	0.0133 pounds per min
Mitigation measures:	NONE
Surrounding terrain type:	Urban surroundings (many obstacles in the immediate area)
Toxic endpoint:	0.01 mg/L; basis: EHS-LOC; LOC is based on IDLH-equivalent level estimated from toxicity data.

Estimated distance to toxic endpoint: 0.1 miles (0.2 kilometers)

----------ASSUMPTIONS ABOUT THIS SCENARIO----------

Wind speed:	3 meters/second (6.7 miles/hour)
Stability class:	D
Air temperature:	77 F

Boron Trichloride Alternative Scenario
Stability Class F and Wind Speed 1.5 m/sec

Text Summary

ALOHA® 5.4.3

```
SITE DATA:
  Location: NEWPORT BEACH, CALIFORNIA
  Building Air Exchanges Per Hour: 0.29 (unsheltered double storied)
  Time: August 30, 2012  0940 hours PDT (using computer's clock)

CHEMICAL DATA:
  Warning: BORON TRICHLORIDE can react with water and/or water vapor to
  produce hydrochloric acid and heat.  ALOHA cannot accurately predict the
  air hazard if a reaction occurs.
  Chemical Name: BORON TRICHLORIDE       Molecular Weight: 117.17 g/mol
  PAC-1: 0.19 ppm    PAC-2: 2.1 ppm      PAC-3: 2.1 ppm
  Ambient Boiling Point: 54.5° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 1.5 meters/second from N at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 56° F
  Stability Class: F (user override)
  No Inversion Height                    Relative Humidity: 80%

SOURCE STRENGTH:
  Direct Source: 0.0133 pounds/min       Source Height: 0
  Release Duration: 1 minute
  Release Rate: 2.22e-04 pounds/sec
  Total Amount Released: 0.013 pounds
  Note: This chemical may flash boil and/or result in two phase flow.

THREAT ZONE: (GAUSSIAN SELECTED)
  Model Run: Gaussian
  Red    : 28 yards --- (2.0 ppm)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
```

Chlorine

OFF-SITE CONSEQUENCE ANALYSIS CALCULATIONS

Chlorine - Worst Case Scenario

Maximum quantity - one cylinder	110	lb
Quantity released	110	lb
Release duration	10	min
Release rate	11	lb/min
Inside building mitigation factor	0.55	
Q (release rate to outdoors)	6.05	lb/min
Wind Speed	1.5	m/sec
Temperature	77	F
Toxic endpoint	3	ppm
RMP*Comp results to	0.2	mi
toxic endpoint of 3 ppm	1,056	ft
Distance to nearest residential receptor	190	ft
Potential impact to nearest receptor	Yes	

RMP*Comp: Results of Consequence Analysis

Scenario Summary
Aug 14, 2012

Chemical:	Chlorine
CAS number:	7782-50-5
Threat type:	Toxic Gas
Scenario type:	Worst-case
Physical state:	Liquefied under pressure
Quantity released:	110 pounds
Release duration:	10 min
Release rate:	6.05 pounds per minute
Mitigation measures:	Release in enclosed space, in direct contact with outside air
Surrounding terrain type:	Urban surroundings (many obstacles in the immediate area)
Toxic endpoint:	0.0087 mg/L; basis: ERPG-2

Estimated distance to toxic endpoint: 0.2 miles (0.3 kilometers)

----------ASSUMPTIONS ABOUT THIS SCENARIO----------

Wind speed:	1.5 meters/second (3.4 miles/hour)
Stability class:	F
Air temperature:	77 F

OFF-SITE CONSEQUENCE ANALYSIS CALCULATIONS

Chlorine - Alternative Scenario

Scenario assumes discharge from rupture of process gas line (1/3-inch)
Chlorine cylinders equipped with 0.03-inch restricted flow orifices (RFOs) to limit release

Heat capacity ratio of gas:	1.34		
Hole size based on RFO limiting flow	0.762	mm	0.03 inch
Upstream pressure:	6.89	bar abs	85.3 psig
Dowstream pressure:	1.01	bar abs	
Temperature:	298	K	
Gas molecular weight:	70.91		

Excess Head Loss Factors:

Entrance:	0.5
Exit:	1
Others:	0
TOTAL:	1.5

Calculated Results:

Hole area:	4.56E-07	m**2		
Upstream gas density:	19.72	kg/m**3		
Expansion factor, Y:	0.614			
Heat capacity ratio, k:	1.2	1.4	1.67	
Sonic pressure ratios:	0.536	0.575	0.618	
Choked pressure:	3.20	2.93	2.63	bar
Mass flow:	0.0009	0.0009	0.0009	kg/s

Interpolation table:

1.2	0.0008729
1.4	0.000904

Interpolated mass flow:	0.0009	kg/s	0.12 lb/min

Chlorine cylinders are stored in 2-cylinder gas cabinets
Gas cabinets require exhaust ventilation as per 2010 CA Fire Code (Section 3704.1.2)
Requires 200 linear feet/min of air at face of gas cabinet

Vendor minimum ventilation flow rate	250	cfm	
Dilution factor with exhaust air			
FR = 1 - exp(-WT/V)			
W = air flow rate	250	cfm	
T = time (minutes)	1	min	
V = volume of gas cabinet (25" x 23" x 87")	28.95	ft3	
FR	0.9998		
Assume 99% reduction to be conservative	0.9900		
Release rate with mitigation = (1-FR) x QR	0.0012	lb/min	
Release duration	1.0	min	active mitigation - activation of automatic shutoff valves
Wind Speed	1.5	m/sec	
Average nighttime temperature - Newport Beach	56	F	
Relative Humidity (nighttime conditions)	80	%	
Urban or Rural	Urban		
Ht of release - conservatively assume same height as Phase I receptor in multi-story building	Ground level		
RMP*Comp - distance to	<0.1	miles	
toxic endpoint of 3 ppm	<528	feet	
ALOHA results - Distance to toxic endpoint of 3 ppm	<33	ft	
Distance to nearest residential receptor	190	ft	
Potential impact to nearest receptor	No		

RMP*Comp: Results of Consequence Analysis

Scenario Summary
Aug 30, 2012

Chemical:	Chlorine
CAS number:	7782-50-5
Threat type:	Toxic Gas
Scenario type:	Alternative
Physical state:	Liquefied under pressure
Release duration:	1 minutes
Release rate:	0.0012 pounds per min
Mitigation measures:	NONE
Surrounding terrain type:	Urban surroundings (many obstacles in the immediate area)
Toxic endpoint:	0.0087 mg/L; basis: ERPG-2

Estimated distance to toxic endpoint: <0.1 miles (<0.16 kilometers); report as 0.1 mile

----------ASSUMPTIONS ABOUT THIS SCENARIO----------

Wind speed:	3 meters/second (6.7 miles/hour)
Stability class:	D
Air temperature:	77 F

Chlorine Alternative Scenario
Stability Class F and Wind Speed 1.5 m/sec

Text Summary

ALOHA® 5.4.3

```
SITE DATA:
  Location: NEWPORT BEACH, CALIFORNIA
  Building Air Exchanges Per Hour: 0.29 (unsheltered double storied)
  Time: August 30, 2012  0940 hours PDT (using computer's clock)

CHEMICAL DATA:
  Chemical Name: CHLORINE                  Molecular Weight: 70.91 g/mol
  AEGL-1 (60 min): 0.5 ppm   AEGL-2 (60 min): 2 ppm   AEGL-3 (60 min): 20 ppm
  IDLH: 10 ppm
  Ambient Boiling Point: -29.3° F
  Vapor Pressure at Ambient Temperature: greater than 1 atm
  Ambient Saturation Concentration: 1,000,000 ppm or 100.0%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 1.5 meters/second from N at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 56° F
  Stability Class: F (user override)
  No Inversion Height                    Relative Humidity: 80%

SOURCE STRENGTH:
  Direct Source: 0.0012 pounds/min       Source Height: 0
  Release Duration: 1 minute
  Release Rate: 2e-05 pounds/sec
  Total Amount Released: 0.0012 pounds
  Note: This chemical may flash boil and/or result in two phase flow.

THREAT ZONE: (GAUSSIAN SELECTED)
  Model Run: Gaussian
  Red    : less than 10 meters(10.9 yards) --- (3 ppm = ERPG-2)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
```

Hydrofluoric Acid

OFF-SITE CONSEQUENCE ANALYSIS CALCULATIONS

Hydrofluoric acid (49%) - Worst Case Scenario

Maximum quantity	211	gallons
Density of 49% HF acid	9.6	lb/gal
Release amount	2025.6	lb

Conservatively assume all HF acid
in bulk storage tank spills into bay

Passive mitigation (release inside building) assumed

Release amount	2025.6	lb
Release duration	10	min
Calculated release rate (RMP*Comp)	55.7	lb/min
Wind Speed	1.5	m/sec
Temp (highest max last 3 yrs)	87	F
Toxic endpoint	20	ppm
RMP*Comp - distance to	1.2	miles
toxic endpoint of 20 ppm	6,336	feet
Distance to nearest residential receptor	235	ft
Potential impacts to nearest receptor	Yes	

RMP*Comp: Results of Consequence Analysis

Scenario Summary
Aug 15, 2012

Chemical:	Hydrofluoric acid
Initial concentration:	50 %
CAS number:	7664-39-3
Threat type:	Toxic Liquid
Scenario type:	Worst-case
Liquid temperature:	87 F
Quantity released:	2026 pounds
Release duration:	10 min
Release rate:	55.7 pounds per minute
Mitigation measures:	Release in enclosed space, in direct contact with outside air
Surrounding terrain type:	Urban surroundings (many obstacles in the immediate area)
Toxic endpoint:	0.016 mg/L; basis: ERPG-2

Estimated distance to toxic endpoint: 1.2 miles (1.9 kilometers)

----------ASSUMPTIONS ABOUT THIS SCENARIO----------

Wind speed:	1.5 meters/second (3.4 miles/hour)
Stability class:	F
Air temperature:	87 F

OFF-SITE CONSEQUENCE ANALYSIS CALCULATIONS

Hydrofluoric acid (49%) - Alternative Release Scenario

Maximum quantity	211	gallons	
Storage Bay #1 dimensions			
Length	32	ft	
Width	28	ft	
Area	896	ft^2	
Conservatively assume all HF acid is			
in bulk storage tank and spills into bay			
Wind Speed	1.5	m/sec	
Average nighttime temperature - Newport Beach	56	F	
Relative Humidity (nighttime conditions)	80	%	
Urban or Rural	Urban		
Ht of release	Ground level		
Toxic endpoint	20	ppm	
For liquid release inside building per USEPA OCA guidance			
$Q = U^{0.78}$ x LFA X A = release rate			
U = wind speed (m/sec)	0.1		per USEPA guidance for inside a building
LFA = liquid factor ambient	0.0014		
A = area of room	896	ft^2	
Q (evaporation rate)	0.21	lb/min	
Inside bldg release factor	0.1		
Q (release rate to outdoors)	0.02	lb/min	
Release duration (as per OCAG Guidance)	10.0	min	
Total lb. released	0.2	lb	
RMP*Comp - distance to	0.1	miles	
toxic endpoint of 20 ppm	528	feet	
ALOHA results - Distance to	81	ft	
toxic endpoint of 20 ppm			
Distance to nearest residential receptor	235	ft	
Potential impact to nearest receptor	No		

RMP*Comp: Results of Consequence Analysis

Scenario Summary
Aug 15, 2012

Chemical:	Hydrofluoric acid
Initial concentration:	50 %
CAS number:	7664-39-3
Threat type:	Toxic Liquid
Scenario type:	Alternative
Liquid temperature:	87 F
Quantity released:	2.1 pounds
Release duration:	10 min
Release rate:	0.0578 pounds per minute
Mitigation measures:	Release in enclosed space, in direct contact with outside air
Surrounding terrain type:	Urban surroundings (many obstacles in the immediate area)
Toxic endpoint:	0.016 mg/L; basis: ERPG-2

Estimated distance to toxic endpoint: 0.1 miles (0.2 kilometers)

----------ASSUMPTIONS ABOUT THIS SCENARIO----------

Wind speed:	3 meters/second (6.7 miles/hour)
Stability class:	D
Air temperature:	87 F

```
SITE DATA:
  Location: NEWPORT BEACH, CALIFORNIA
  Building Air Exchanges Per Hour: 0.29 (unsheltered double storied)
  Time: August 30, 2012  1027 hours PDT (using computer's clock)

CHEMICAL DATA:
  Warning: HYDROGEN FLUORIDE can react with water and/or water vapor.  This
  can affect the evaporation rate and downwind dispersion.  ALOHA cannot
  accurately predict the air hazard if this substance comes in contact with
  water.
  Chemical Name: HYDROGEN FLUORIDE       Molecular Weight: 20.01 g/mol
  AEGL-1 (60 min): 1 ppm   AEGL-2 (60 min): 24 ppm   AEGL-3 (60 min): 44 ppm
  IDLH: 30 ppm
  Ambient Boiling Point: 67.1° F
  Vapor Pressure at Ambient Temperature: 0.80 atm
  Ambient Saturation Concentration: 796,357 ppm or 79.6%

ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
  Wind: 1.5 meters/second from N at 3 meters
  Ground Roughness: urban or forest      Cloud Cover: 5 tenths
  Air Temperature: 56° F
  Stability Class: F (user override)
  No Inversion Height                    Relative Humidity: 80%

SOURCE STRENGTH:
  Direct Source: 0.02 pounds/min         Source Height: 0
  Release Duration: 10 minutes
  Release Rate: 0.02 pounds/min
  Total Amount Released: 0.20 pounds

THREAT ZONE: (GAUSSIAN SELECTED)
  Model Run: Gaussian
  Red   : 27 yards --- (20 ppm = ERPG-2)
  Note: Threat zone was not drawn because effects of near-field patchiness
     make dispersion predictions less reliable for short distances.
```

Sulfuric Acid

OFF-SITE CONSEQUENCE ANALYSIS CALCULATIONS

Sulfuric acid (93%) - Worst Case Scenario

Maximum quantity released	2,000	gallons
Density	15.3	lb/gal for 96% H2SO4
Maximum quantity released	30600	lb

Conservatively assume all sulfuric acid in the container spills onto the concrete floor with no containment

Wind Speed	1.5	m/sec
Temp (highest max last 3 yrs)	87	F
Humidity	50	%
Urban or Rural	Urban	
Ht of release	Ground level	
Toxic endpoint	10	mg/m^3

ALOHA input parameters - puddle

Amount of liquid spilled	2000	gallons
Amount of liquid spilled	267.4	ft^3
Depth of puddle	1	cm
Depth of puddle	0.03	ft
Area of puddle	8149.33	ft^2
Diameter of puddle	90.27	ft

ALOHA results - Distance to toxic endpoint of 10 mg/m^3	252	ft
Distance to nearest residential receptor	100	ft
Potential impacts to nearest receptor	Yes	

Text Summary

93% Sulfuric Acid - Worst Case Scenario

ALOHA® 5.4.3

```
 SITE DATA:
   Location: NEWPORT BEACH, CALIFORNIA
   Building Air Exchanges Per Hour: 0.33 (unsheltered double storied)
   Time: August 15, 2012  1742 hours PDT (using computer's clock)

 CHEMICAL DATA:
   Warning: OLEUM can react with water and/or water vapor.  This can affect
   the evaporation rate and downwind dispersion.  ALOHA cannot accurately
   predict the air hazard if this substance comes in contact with water.
   Chemical Name: OLEUM                    Solution Strength: 4% (by weight)
   Ambient Boiling Point: 426.2° F
   Partial Pressure at Ambient Temperature: 4.80e-004 atm
   Ambient Saturation Concentration: 480 ppm or 0.048%
   Hazardous Component: SULFUR TRIOXIDE
   Molecular Weight: 80.06 g/mol
   AEGL-1 (60 min): 0.2 mg/(cu m)   AEGL-2 (60 min): 8.7 mg/(cu m)   AEGL-3 (60
min): 160 mg/(cu m)

 ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
   Wind: 1.5 meters/second from N at 3 meters
   Ground Roughness: urban or forest      Cloud Cover: 5 tenths
   Air Temperature: 87° F
   Stability Class: F (user override)
   No Inversion Height                    Relative Humidity: 50%

 SOURCE STRENGTH:
   Evaporating Puddle
   Puddle Area: 8149 square feet
   Average Puddle Depth: 1 centimeters
   Ground Type: Concrete                  Ground Temperature: 87° F
   Initial Puddle Temperature: Ground temperature
   Release Duration: ALOHA limited the duration to 1 hour
   Max Average Sustained Release Rate: 0.515 pounds/min
      (averaged over a minute or more)
   Total Amount Hazardous Component Released: 30.8 pounds

 THREAT ZONE:
   Model Run: Gaussian
   Red   : 84 yards --- (10 mg/(cu m) = ERPG-2)
```

OFF-SITE CONSEQUENCE ANALYSIS CALCULATIONS

Sulfuric acid (93%) - Alternative Release Scenario
Assume release of 10% of the tank volume
due to tank leak or break in the process piping

Maximum quantity released	200	gallons
Density	15.3	lb/gal for 96% H2SO4
Maximum quantity released	3060	lb

Conservatively assume all sulfuric acid in the container
spills onto the concrete floor with no containment

Wind Speed	1.5	m/sec
Average nighttime temperature - Newport Beach	56	F
Relative Humidity (nighttime conditions)	80	%
Urban or Rural	Urban	
Ht of release	Ground level	

Toxic endpoint	10	mg/m^3

ALOHA input parameters - puddle

Amount of liquid spilled	200	gallons
Amount of liquid spilled	26.7	ft^3
Depth of puddle	1	cm
Depth of puddle	0.03	ft
Area of puddle	814.93	ft^2
Diameter of puddle	28.55	ft

ALOHA results - Distance to toxic endpoint of 10 mg/m^3	57	ft
Distance to nearest residential receptor	100	ft
Potential impacts to nearest receptor	No	

Text Summary

ALOHA® 5.4.3

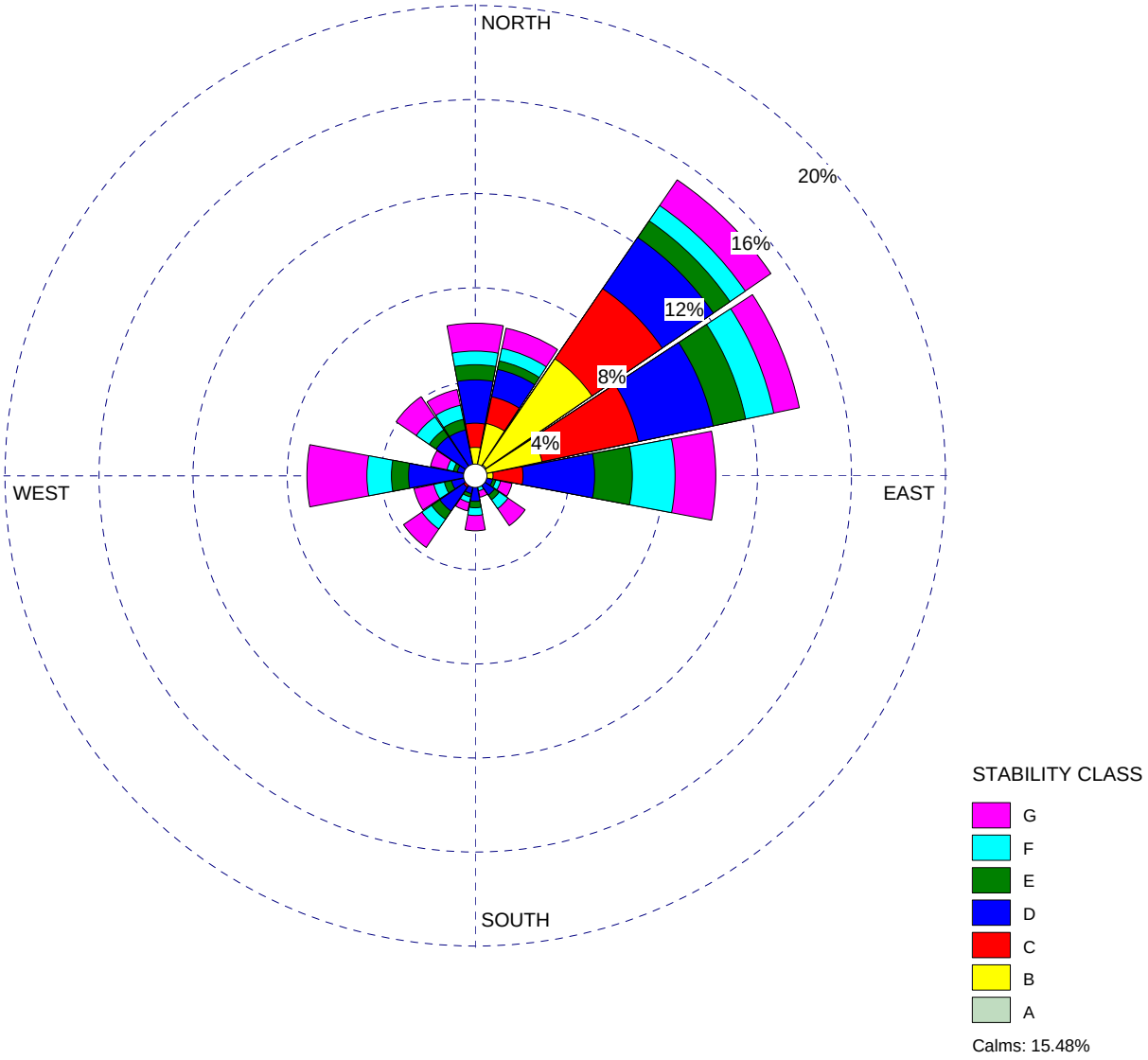
```
 SITE DATA:
   Location: NEWPORT BEACH, CALIFORNIA
   Building Air Exchanges Per Hour: 0.29 (unsheltered double storied)
   Time: August 30, 2012  1027 hours PDT (using computer's clock)

 CHEMICAL DATA:
   Warning: OLEUM can react with water and/or water vapor.  This can affect
   the evaporation rate and downwind dispersion.  ALOHA cannot accurately
   predict the air hazard if this substance comes in contact with water.
   Chemical Name: OLEUM                    Solution Strength: 4% (by weight)
   Ambient Boiling Point: 426.2° F
   Partial Pressure at Ambient Temperature: 1.98e-004 atm
   Ambient Saturation Concentration: 198 ppm or 0.020%
   Hazardous Component: SULFUR TRIOXIDE
   Molecular Weight: 80.06 g/mol
   AEGL-1 (60 min): 0.2 mg/(cu m)   AEGL-2 (60 min): 8.7 mg/(cu m)   AEGL-3 (60
min): 160 mg/(cu m)

 ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)
   Wind: 1.5 meters/second from N at 3 meters
   Ground Roughness: urban or forest      Cloud Cover: 5 tenths
   Air Temperature: 56° F
   Stability Class: F (user override)
   No Inversion Height                    Relative Humidity: 80%

 SOURCE STRENGTH:
   Evaporating Puddle
   Puddle Area: 815 square feet
   Average Puddle Depth: 1 centimeters
   Ground Type: Concrete                  Ground Temperature: 56° F
   Initial Puddle Temperature: Ground temperature
   Release Duration: ALOHA limited the duration to 1 hour
   Max Average Sustained Release Rate: 0.03 pounds/min
      (averaged over a minute or more)
   Total Amount Hazardous Component Released: 1.66 pounds

 THREAT ZONE: (GAUSSIAN SELECTED)
   Model Run: Gaussian
   Red   : 19 yards --- (10 mg/(cu m) = ERPG-2)
   Note: Threat zone was not drawn because effects of near-field patchiness
      make dispersion predictions less reliable for short distances.
```

WIND ROSE PLOT:

Costa Mesa Wind Rose

DISPLAY:

Stability Class



COMMENTS:	DATA PERIOD: **Start Date: 1/1/1981 - 00:00** **End Date: 12/31/1981 - 23:00**	COMPANY NAME:	
		MODELER:	
	CALM WINDS: **15.48%**	TOTAL COUNT: **8760 hrs.**	
	AVG. WIND SPEED: **1.54 m/s**	DATE: **8/23/2012**	PROJECT NO.:

Relative Humidity - Newport Beach CA

	Morning	Afternoon
Jan	79	56
Feb	81	57
Mar	82	57
Apr	79	55
May	77	58
Jun	79	59
Jul	81	57
Aug	81	57
Sep	81	56
Oct	80	57
Nov	79	59
Dec	78	56
Avg	79.75	57

Maximum RH occurs just before sunrise
Use 80% for nighttime analyses

Avg. nighttime lows of 56 F